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Combined 3rd & 4th Quarterly Circulars for 1947

January, 1948

C. P. Ltd., COLOMBO.

Rubber Research Scheme (Ceylon)

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NOTICES

DARTONFIELD ESTATE — VISITORS' DAY

The services of technical officers are available to visitors on the second Wednesday in each month ; the assistant estate superintendent is available every Wednesday. Visitors are requested to arrive on the estate not later than 9-30 a.m.

Visitors will be welcomed at the station on other days provided an appointment has been made in advance.

Dartonfield Estate is situated about 3½ miles from the main Matugama-Agalawatta Road, the turn-off being near culvert No. 14/10. The distance from Colombo is approximately 47 miles.

PUBLICATIONS

Rubber Research Scheme publications comprising Annual Reports Quarterly Circulars and occasional Bulletins and Advisory Circulars are available without charge to the Proprietors (resident in Ceylon), Superintendents and Local Agents of Rubber estates in Ceylon over 10 acres in extent. Forms of application for registration may be obtained from the Director. Extra copies of publications can be supplied to the Superintendents of large estates for the use of their assistants.

ADVISORY CIRCULARS

The undernoted Circulars may be obtained on application at 25 cents per copy. Future issues in the series will be sent free of charge to estates registered for the receipt of our publications :

(1) Notes on budgrafting procedure. (Revised June, 1943).
(3) Notes on Rubber seedling nurseries. (Revised September, 1943).
(4) Contour lining, holing and filling, cutting of platforms, trenches and drains. (Revised June, 1943).
(5) Straining box for latex (January, 1940).
(6) Notes on the care of budded trees of clone Tjirandji 1 with special reference to wind damage (September, 1938).
(8) Planting and after-care of budded stumps. (Revised June, 1943).
(10) Root disease in replanted areas (August, 1939).
(14) Rat Control (September, 1940).
(16) Increasing the crops from Ceylon Rubber Estates (January, 1942) and two Supplements.
(17) Tapping young budded trees (May, 1942) and two Supplements.
(18) Rubber manuring under wartime conditions. (November, 1942).
(19) Density of Planting and Thinning-out (December, 1942).
(20) Planting material recommended for use (1944). (Revised May, 1944).
(21) The Control of Bark Rot and Canker. (April, 1944).
(22) Oidium Leaf Disease (April, 1944) and two Supplements.
(23) Uniformity in the Nomenclature of Clones and Clonal Seedlings (December, 1944).
(24) Treatment of Brown Bast (December, 1944).
(25) Ground Covers (January, 1945).

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AGRICULTURAL EXPERIMENTAL WORK OF RUBBER RESEARCH SCHEME—INTRODUCTION

By C. G. HANSFORD, L. A. WHELAN AND C. A. DE SILVA

With the termination of the special conditions under which Ceylon rubber was produced during the war period, when maximum possible production was demanded practically regardless of expense, and good returns were possible from the favourable market conditions, the whole rubber industry is faced with a complete reorganisation in the face of what appears to be the onset of "slump" conditions. The primary consideration is now the production of reasonable amounts of rubber at minimum costs. At the same time the Rubber Research Scheme has had several staff changes and to some extent this has involved a re-shaping of its programme and long-term policy. Therefore the present seems a convenient time at which to present a connected account of its past experimental work and a discussion of experiments still in progress and those planned for the next five or six years. The programme of present and future work has been adjusted to reflect the new prospects of the Ceylon rubber industry and to assist it in meeting the stringent conditions likely to govern its activities in the future.

The broad divisions of the experimental work of the Rubber Research Scheme can be summarised as investigations on :

(1) Economic measures for opening new plantations.

(2) Economic methods of rejuvenation of the old seedling areas still constituting the bulk of Ceylon estates, and the majority of which are assumed to have more or less completed their useful life.

(3) The provision of improved material for planting—Clones, Clonal Seed, Stocks.

(4) Economic methods of bringing the new fields into production—Cover Crops, Manures.

(5) Economic methods of production—Tapping Systems, Manures.

In this present series of articles it is proposed to deal with the whole of the series of Field Experiments carried out by the Rubber Research Scheme and to show what information can be drawn from them and used as a basis for assistance and advice to planters on the matters classified above. (A great part of the information derived from the experimental work has already been incorporated in the Advisory Circulars issued by the Rubber Research Scheme). Many of the questions raised when due consideration is given to the details included under those broad heads are unfortunately not capable of investigation by field experiments within the comparatively restricted facilities available, and can be answered only by the accumulation of general field experience, either from the fields of our Experiment Stations, or on a basis of broad comparison of general experience on commercial estates. Several questions have in fact been more or less solved by general consensus of opinion amongst the planting community, while others, involving detailed cost accounting under the

very varied conditions on different estates, are probably not capable of any general solution which would apply to any large number of individual estates. On some of these matters there is very great divergence of opinion amongst planters, and though there is reason to believe that to some extent their opinions may be merely the result of personal bias, there is often some foundation of actual experience to support each view. Conditions and opinions in the rubber industry in Ceylon are not unique in these respects and even amongst farming communities in old established countries where a much greater volume of research has been carried out, there are often ideas running counter to present experimental results, which when thoroughly sifted and used as a basis for further research, will lead in a number of cases to valuable results, whether finally proved correct or erroneous. In agricultural research, therefore, it is important that both the research workers themselves and the planting communities they serve, should realise that there is no finality whatsoever, and that all that is possible is to present the results as the basis of our present knowledge in the hope that further investigation will in large part confirm them, but leaving the door wide open for future improvements.

These remarks apply with especial force to matters under the head of "planting material," especially under present circumstances resulting from war conditions in the East. In Malaya and the Dutch East Indies many new clones and seedling families were planted experimentally in the years preceding 1941, and results have been unobtainable from them till now. There is therefore a very considerable possibility that when these results become available during the next two or three years, they may indicate the existence of new varieties of rubber showing a considerable advance on our present standard types, and will necessitate considerable modifications in our recommendations.

I. OPENING NEW PLANTATIONS

A. "No Burn" Clearings at Nivitigalakele Estate.

At Nivitigalakele two areas were opened from jungle for planting rubber in 1940 and 1941, and as these new plantings are now coming into regular tapping, the present appears a suitable occasion on which to summarise our experience with the two clearings. Before dealing with costs as compared with the usual methods of clearing jungle for rubber planting in Ceylon, at the cost of some repetition, the operations used in making these special clearings may be restated, with remarks indicating what modifications leading to economy might be made. (The original account of the clearings was published on pp. 72-77 of the Second Quarterly Circular of the Rubber Research Scheme, June, 1940).

In both clearings the land consists of very steep hillsides, originally covered by medium forest. It was first necessary to make inspection paths through the jungle in order to ascertain the nature and lie of the land, and to determine the best position from which to commence lining out operations. These were started on the steepest part of the slope so as to obtain divergent contour lines and thus provide the maximum number of unbroken planting lines. Lining out and clearing of rentices were carried out simultaneously, sufficient undergrowth being cleared in the first stage to mark the contours as sighted with a road tracer, with marking pegs at 40-50 ft. intervals along the lines, and the successive contour lines spaced 24 ft. apart. Intermediate contour lines were marked where adjacent main lines diverged more than 40 ft. The next stage was to clear the under-

growth to 3 ft. on either side of the initial contour lines to give a cleared rentice of 6 ft. width, in which the holes were marked and dug in the usual manner. All jungle trees coinciding with the position of the planting hole or anti-erosion trench were removed by felling below ground level after cutting sufficient main roots. This obviated the need for subsequent stumping.

The next operation was to cut trenches 18" deep, 30" wide and 10' 6" long between the planting holes, as an anti-erosion measure. Experience with the clearings has shown that this operation was quite unnecessary at this stage, as even today, 8 years after the original clearing was commenced, the trenches are still practically empty of eroded soil, and it can be stated that under the conditions which have operated in these clearings, there has been virtually no soil erosion at all. Added to this there is the present disadvantage that when the rubber canopy closes in to kill out more or less the remaining dense cover of natural vegetation and thus to expose the soil to erosion the trenches are neither in the most convenient nor the most advantageous position, being situated along the contour in the planting lines ; also there is the danger that the root system of the rubber trees may be cramped and the trees themselves more liable to be felled by high wind on account of the proximity of the trenches. Summarising our experience, it could not be recommended to planters making clearing from jungle on this "No Burn" system to include any form of trenching or pitted drains during the early years of such clearings, when the very dense growth of natural vegetation completely prevents all soil erosion, and the little that might occur in the 6 ft. planting lines is held up immediately by the adjacent vegetation. All earthworks designed for control of erosion should therefore be postponed until the natural vegetation between the lines of rubber becomes thinned out by the shade from the rubber, when pitted drains or other works can be carried out at a minimum of expense, and in fact much cheaper than at any earlier stage in the clearing.

The final operation in making the clearing at Nivitigalakele was to fell the jungle trees between the planting rentices. At the time this was done little was known of the rate of soil erosion that could be expected to occur in the clearing, and what are now considered as excessive precautions were taken against it. Thus instead of felling the trees as most convenient and cheapest, steps were taken to fell them along the contours or to stack the trunks and branches along contours. Under modern conditions and in the light of our experience, the jungle trees could have been felled in the most convenient manner and allowed to rot where they fell except when they actually interfered with holing and planting operations. The essential of the "No Burn" clearing is that all undergrowth between the planting rentices should remain to act as a preventative of erosion. What happens to the larger trees is a very minor point, save that they cannot be removed and sold as firewood without causing too much damage to soil and undergrowth.

The accompanying Tables I. and II. give the whole cost year by year of the two "No Burn" clearings at Nivitigalakele, and for purposes of rough comparison Table III. showing the costs of a normal clearing made on the same estate in 1939 is included. It will be seen that under the head "Felling and Clearing" the costs of Table I. are eight times and those of Table II. six times those of Table III. A part of the difference may be attributed to a denser jungle stand in the two former areas, but undoubtedly the major difference is due to the special precautions taken as detailed in the preceding paragraph. In the light of our experiences an attempt has been made below to give the operations we now consider best and most economical, with their costs, were we to open up three similar areas today.

(All costs are based on basic wages, comparable with those ruling 1939-41 and not taking into account any subsequent rise in wage rate, nor any Dearness Allowances, so that the costs may be comparable to those of Tables I., II. and III. The survey and felling costs of the "No Burn" clearings are taken as somewhat higher than those for a normal clearing as the former has to be made more detailed in the standing jungle and the latter more careful. Similarly lining is more difficult in the standing jungle than in land burnt over. On the other hand the costs of the anti-erosion earthworks necessary from the outset in normal clearings are avoided entirely at this stage, and much more than counter-balance the additional costs under other items, so that the initial cost of a "No Burn" clearing could be reduced to half or three-quarters that of a normal clearing. There is an additional advantage in that the "No Burn" system lends itself to more rapid conversion of jungle to plantation.

Upkeep of "No Burn" Clearings.

The essential operations have been the control of undergrowth between the planted rentices and weeding in the rentices; both operations have proved more expensive than in the neighbouring normal clearing, though it is difficult to account for the discrepancy in the case of weeding operations, which in the "No Burn" clearings are limited to the rentices while in the normal clearing they cover the whole area. Weeding in the 1939 normal clearing has cost an average of Rs. 10/53 per acre per annum, while in the 1940 and 1941 "No Burn" clearings it has cost Rs. 13/19 and Rs. 14/72 respectively.

Lopping of the undergrowth has cost Rs. 11/67 in the 1940 clearing and Rs. 9/57 in the 1941 clearing per acre per annum. During the first five years of these clearings the undergrowth consisted mainly of a dense mass of bamboo which grew rapidly and tended to spread into the rentices; at the same time war conditions led to labour difficulty so that efficient control and eradication of this type of growth by frequent slashing was not possible. Under more normal conditions it should be possible to get rid of this bamboo at an earlier stage in the clearing and by spending a little more money in the first two years to save on later years. On the other hand the rubber, though it received some check from the bamboo growth, has now grown above it and its shade has now controlled the bamboo, which is being replaced rapidly by other vegetation such as Mikania and other Composites. In future years expenses under this head should be lessened appreciably as the canopy of the rubber closes in and further reduces the undergrowth, but eventually we shall be faced with the necessity of replacing what remains of the natural vegetation by a cover crop. This is being established in the planted rentices, from which it should spread outwards as the undergrowth thins out and we hope that we shall not be troubled with any excessive development of grass weeds in the course of this more or less natural process of replacement. So far it is important to note that there has been practically no soil erosion, and if the process of gradual replacement of natural vegetation by cover crops continues to go according to plan, our final result should be a mature rubber plantation still retaining the original surface soil of the jungle. To do this has cost so far, in the 1940 clearings 30% and in that of the 1941 clearings 46% excess of upkeep costs over those of the 1939 normal clearing.

The growth of the rubber in the three clearings under review has been dealt with in the 1946 Quarterly Circulars, pp. 25-26; all that need be repeated here is that growth has been satisfactory in spite of a period of setback when labour conditions did not permit of satisfactory control of undergrowth.

Summary.

Our experience with "No Burn" clearings at Nivitigalakele shows that this method of opening has the following advantages:—

(*a*) Clearing and planting can be carried out more rapidly and probably cheaper than with normal opening methods.

(*b*) All anti-erosion measures can be postponed until eventually required.

(*c*) Cover crops can be established in the planting rentices and thence spread naturally to replace the intervening undergrowth.

(*d*) The whole of the original jungle surface soil is preserved.

The chief disadvantages are:

(*a*) Careful control of undergrowth is required up to the stage when the rubber canopy exerts its natural control.

(*b*) Inspection of young fields as a whole is difficult.

(*c*) Eventual construction of anti-erosion trenches may damage the rubber roots.

(*d*) Upkeep charges are higher during the first 7 years than in normal clearings.

(*e*) There might be a very high fire risk during the few weeks succeeding the felling operations, but if the felling were postponed until wet weather set in, this risk would be reduced to practically nil. In actual fact no fires have yet been experienced in the "No Burn" clearings at Nivitigalakele.

Summary of Costs.

Per Acre Costs.	*"No Burn."*	*Normal Clearing.*
Survey	9·00 ...	6·00
Felling and Clearing ...	16·00 ...	9·00
Lining	32·00 ...	26·00
Pitted Drains	— ...	40·00
Leader Drains	— ...	6·00
Terracing	— ...	10·00
	Rs. 57·00	Rs. 107·00

Items in opening clearings not included above taken as uniform for all methods of opening land. The above costs, as well as all others detailed in the Tables appended, are calculated from basic wage rates, and do not include any War or Dearness Allowances paid to labour, nor is any provision made in any costs given in these accounts for general overhead and supervision charges.

B. Hedigalla Clearings.

For purposes of general comparison with the costs of the clearings at Nivitigalakele described above, the costings for clearings made at Hedigalla are given in the following tables. Whereas the former estate might be considered as very favourably situated as regards available labour supply, the latter is very much the reverse, being situated 3 miles from a main

road in country only just being opened up for settlement. On this account alone higher costs of all operations at Hedigalla can only be expected. In 1946 and 1947 certain operations of clearing and felling were carried out on a contract basis, whereas all the older clearings and all those at Nivitigalakele were done by estate labour. All the Hedigalla clearings hitherto have been made by the usual system of felling and burning, but in 1947 a great part of the felled timber was sold to firewood contractors, and in the costs the receipts from this source have been entered as a credit item against these clearings. These differences in arrangements at Hedigalla render a direct comparison with costs at Nivitigalakele impossible, but on the other hand the tables below do give some indication of clearing and planting costs under present conditions in a very difficult situation. As in the Nivitigalakele tables of costs above, all costings are calculated on the basic wage paid to labour, not including War and Dearness Allowances.

The land cleared to date at Hedigalla is very steep and parts, especially the 1947 clearings, are very rocky, so that the actual effective acreage, planted with rubber is somewhat less than the total area cleared each year. As in the first years large clearings were made and planted with foodstuffs during the war period, then afterwards with rubber, some difficulty has been experienced in allocation of costs to each field. All expenses on food crops have been omitted from the costs as given here. Planting of covers in the early clearings was difficult as no cuttings of Desmodium were available within easy reach, and we have been forced to await the development of multiplication areas on the estate and a neighbouring estate, meanwhile to plant what is already available. From now on these local sources should prove sufficient to meet our future needs. Hitherto the development of some very close growing natural weed cover has been of great assistance in controlling soil erosion, even on these steep slopes, and we are fortunate in not having encountered any heavy infestation of Illuk (*Imperata*) or other objectionable grasses. Mikania may prove a nuisance in the future, as recent clearings appear to become overgrown with this to a much greater extent than the first clearings made from the forest. Some additional expense on this account may therefore be expected in the future, though for the time being the presence of this weed on the 1947 clearing is on balance advantageous, as it is preventing soil erosion at a time when our cover crops are only just being planted. It is hoped that even with the normal methods of clearing land from forest we shall be able to prevent serious erosion of the original top soil of the forest. The period of greatest danger of erosion is that just succeeding the burn of the bushwood and smaller felled timber, but at Hedigalla the larger timber lay thick enough on the land to control this erosion to a great extent, even during the monsoon period April to June, 1947, when the steepest slopes were most exposed. Some erosion did undoubtedly occur here under these circumstances but we feel the worst is over, now that the land is supporting a heavy weed cover between the lines of planting holes, and it is hoped that the cover crop planted will gradually replace this weed cover without at any future time exposing the soil once more. Further measures to control erosion have been the planting of pine-apples in close lines along the contour, and pitted contour drains are being dug as fast as the available labour supply permits.

The general character of the soil is rather poor, in spite of its having been for a long period under rather heavy forest—should serious erosion of the top-soil occur at any time, we shall be left with a very poor sub-soil and therefore obtain poor growth of the rubber. On this account all practical measures have been adopted from the outset to retain the maximum possible of the forest top-soil.

TABLE 1.

1941 "No Burn" Clearing, Nivitigalakele—14 Acres

	1941 Rs.	1942 Rs.	1943 Rs.	1944 Rs.	1945 Rs.	1946 Rs.	Total Opening	Total Planting Rs.	Total Upkeep Rs.
Survey	—	—	—	—	—	—	—	—	—
Felling and Clearing	692·79	—	—	—	—	—	692·79	—	—
Lining	38·16	—	—	—	—	—	38·16	—	—
Cutting Holes	197·24	—	—	—	—	—	197·24	—	—
Dynamiting	130·53	—	—	—	—	—	130·53	—	—
Filling Holes	77·80	—	—	—	—	—	77·80	—	—
Trenches	681·94	—	—	—	—	—	681·94	—	—
Leader Drains	1·81	1·94	—	—	—	—	3·75	—	—
Budded Stumps	175·47	—	—	—	—	—	—	175·47	—
Planting	57·18	—	—	—	—	—	—	57·18	—
Supplying	1·83	·67	3·23	—	—	1·13	—	—	6·86
Weeding	54·58	124·90	263·36	440·40	285·48	273·44	—	—	1,442·16
Lopping Undergrowth	—	144·68	199·16	209·09	208·42	176·25	—	—	937·60
Fencing	125·77	—	—	—	—	—	125·77	—	—
Roads and Paths	11·11	12·72	14·68	—	56·93	10·73	—	—	106·17
Manuring	67·61	61·49	138·12	67·41	158·31	154·20	—	—	(647·14)
Tools	66·38	—	—	—	—	—	66·38	—	—
Labels	36·66	—	—	—	—	—	—	36·66	—
Baskets	29·25	—	—	—	—	—	—	29·25	—
Temporary Lines	20·44	—	—	—	—	—	20·44	—	—
Repairs to Trenches	6·49	—	—	9·95	—	—	—	—	16·44
Draining Springs	2·42	—	—	—	—	—	2·42	—	—
Pests and Diseases	—	38·82	1·07	2·08	2·71	7·51	—	—	52·19
Replanting	—	—	201·50	—	—	—	—	201·50	—
Budding and Attention	—	7·53	28·99	—	1·43	—	—	—	37·95
Watchman	—	105·31	71·84	103·43	53·45	52·66	—	—	(386·69)
	2,475·46	498·06	921·95	832·36	766·73	675·92	2,037·22	500·06	2,599·37

Per Acre

Opening	145·52			Watchman	386·69
Planting	35·72			Manuring	647·14
Manuring	46·22	Per Year	7·70		
Upkeep	185·67	Per Year	30·93	Grand Total	6,170·48
Watchman	27·62	Per Year	4·60		
Total	440·75		43·23		

TABLE II.

1940 "No Burn" Clearing, Nivitigalakele—10 Acres

	1940 Rs.	1941 Rs.	1942 Rs.	1943 Rs.	1944 Rs.	1945 Rs.	1946 Rs.	Totals Opening Rs.	Totals Planting Rs.	Totals Upkeep Rs.
Survey	91·00	—	—	—	—	—	—	(91·00)	—	—
Felling and Clearing ...	539·58	—	—	—	—	—	—	539·58	—	—
Lining	28·74	—	—	—	—	—	—	28·74	—	—
Holing	207·59	—	—	—	—	—	—	207·59	—	—
Dynamiting	109·18	—	—	—	—	—	—	109·18	—	—
Filling Holes	123·71	—	—	—	—	—	—	123·71	—	—
Trenches	417·02	214·43	92·64	—	—	91·42	—	417·02	—	398·49
Leader Drains ...	46·75	—	5·89	—	—	—	—	46·75	—	5·89
Budded Stumps ...	202·71	—	—	—	—	—	—	—	202·71	—
Planting	58·94	—	—	—	—	—	—	—	58·94	—
Supplying	·57	1·77	1·98	2·49	—	—	—	—	—	6·81
Weeding	23·64	79·44	86·34	159·65	258·94	159·35	155·95	—	—	923·31
Lopping Undergrowth ...	—	88·62	116·28	185·47	159·37	104·21	162·66	—	—	816·61
Fencing	154·70	—	5·50	3·22	—	—	—	154·70	—	8·72
Roads and Paths ...	25·17	1·81	9·54	2·90	1·75	16·42	4·81	—	—	62·40
Manuring	27·00	81·06	54·33	233·78	321·53	263·60	269·54	—	—	(1,250·84)
Tools	51·02	—	—	—	—	—	—	51·02	—	—
Labels	59·09	—	—	—	—	—	—	—	59·09	—
Baskets	42·00	—	—	—	—	—	—	—	42·00	—
Temporary Lines ...	13·58	—	—	—	—	—	—	13·58	—	—
Repairs to Drains ...	5·68	—	—	—	—	—	—	—	—	5·68
Pests and Diseases ...	22·32	18·62	9·13	1·16	—	43·65	11·54	—	—	106·42
Draining Springs ...	99·96	—	—	—	—	—	—	99·96	—	—
Budding and Attention	—	47·18	1·38	1·20	10·51	—	1·77	—	—	62·04
Watchman	—	102·51	105·29	35·96	51·74	53·44	52·66	—	—	(401·60)
	2,349·95	635·44	488·30	625·83	803·84	732·09	658·93	1,791·83	362·74	2,396·37

Per Acre

Survey	9·10		
Opening	179·18		
Planting	36·27		
Manuring ...	125·08	Per Year	17·87
Upkeep	239·64	Per Year	34·23
Watchman ...	40·16	Per Year	5·75
	629·43		57·85

Survey	91·00
Manuring	1,250·84
Watchman	401·60
Grand Total	6,294·38

TABLE III.

1939 Normal Clearing, Nivitigalakele—9½ Acres

	1939 Rs.	1940 Rs.	1941 Rs.	1942 Rs.	1943 Rs.	1944 Rs.	1945 Rs.	Totals Opening Rs.	Planting Rs.	Upkeep Rs.
Survey	59·20	—	—	—	—	—	—	(59·20)	—	—
Felling and Clearing ...	87·68	—	—	—	—	—	—	87·68	—	—
Lining	25·71	—	—	—	—	—	—	25·71	—	—
Cutting Holes	155·40	—	—	—	—	—	—	155·40	—	—
Dynamiting	160·38	—	—	—	—	—	—	160·38	—	—
Filling Holes	91·12	—	—	—	—	—	—	91·12	—	—
Pitted Drains	388·10	—	—	—	—	—	—	388·10	—	—
Leader Drains ...	60·25	—	—	—	—	—	—	60·25	—	—
Budded Stumps ...	217·06	—	—	—	—	—	—	—	217·06	—
Planting	30·70	—	—	—	—	—	—	—	30·70	—
Supplying	—	6·78	2·95	1·69	—	—	—	—	11·42	—
Weeding	64·94	95·23	73·54	68·93	101·40	193·74	102·79	—	—	700·57
Cover Crops	98·97	—	8·45	—	—	—	—	—	98·97	8·45
Lopping Covers ...	4·32	17·03	77·93	67·57	41·30	—	56·05	—	—	264·20
Fencing	81·34	—	1·80	—	—	—	—	83·14	—	—
Roads and Paths ...	51·62	1·98	19·97	69·08	3·19	5·93	97·56	—	—	249·33
Manures	42·75	74·81	168·49	210·95	167·02	148·52	260·15	—	—	(1,072·69)
Tools	71·86	—	53·46	—	—	—	—	71·86	—	53·46
Labels	62·53	—	1·42	—	—	—	—	—	63·95	—
Baskets	45·50	—	—	—	—	—	—	—	45·50	—
Temporary Lines ...	29·02	—	—	—	—	—	—	29·02	—	—
Terracing	108·70	—	—	—	—	—	—	108·70	—	—
Repairs to Drains ...	56·84	51·49	—	—	—	—	—	—	—	108·33
Pests and Diseases ...	8·17	2·77	17·67	9·60	3·49	7·16	43·80	—	—	92·66
Budding and Attention		69·34	10·72	3·29	7·00	—	—	—	—	90·35
Watchman		102·50	—	—	—	—	—	—	—	(102·50)
	2,002·16	320·85	537·48	431·11	323·40	355·35	560.35	1,261·36	467·60	1,567·35

Per Acre				
Survey	6·24			
Opening	132·77			
Planting	49·22			
Manuring ...	112·91	Per Year	16·13	
Upkeep	164·98	Per Year	23·57	
Watchman ...	10·80	Per Year	1·54	
	476·92		41·24	

Survey ...	29·20
Manures ...	1,072·69
Watchman ...	102·50
	4,530·70

TABLE IV.

Hedigalla 1943 Clearing—11 Acres

	1943 Rs.	1944 Rs.	1945 Rs.	1946 Rs.	Total Clearing Rs.	Total Planting Rs.	Total Upkeep Rs.
Survey	83·07	—	—	—	83·07	—	—
Felling and Clearing	633·12	—	—	—	633·12	—	—
Lining	13·32	—	—	—	13·32	—	—
Holing	291·36	—	—	—	291·36	—	—
Dynamiting	49·95	—	—	—	49·95	—	—
Filling Holes	92·34	—	—	—	92·34	—	—
Trenches	169·62	—	—	—	169·62	—	—
Leader Drains	41·17	—	7·18	—	41·17	—	7·18
Budded Stumps	657·61	—	—	—	—	657·61	—
Planting	70·02	—	—	—	—	70·02	—
Supplying	—	—	3·19	—	—	—	3·19
Weeding	159·08	476·53	497·31	186·76	—	159·08	1,160·60
Forking Illuk	—	—	—	—	—	—	—
Cover Crops	—	15·88	71·98	—	—	87·86	—
Lopping Covers	—	—	25·12	·88	—	—	26·00
Fencing	222·20	—	—	1·51	222·20	—	1·51
Roads and Paths	6·85	8·35	31·74	3·60	6·85	—	43·69
Manures	30·36	112·91	70·86	102·22	—	—	316·35
Tools	91·14	—	—	—	91·14	—	—
Labels	10·13	—	—	—	—	10·13	—
Baskets	236·31	—	—	—	—	236·31	—
Temporary Lines	66·87	—	—	—	66·87	—	—
Terracing	—	—	—	—	—	—	—
Repairs to Trenches	6·41	—	—	57·53	—	—	63·94
Pests and Diseases	12·48	6·75	6·62	·42	—	—	26·27
Budding and Attention	—	47·39	24·98	·93	—	—	73·30
Watchman	—	80·58	145·51	65·84	—	—	291·93
	2,943·41	748·39	884·49	419·69	1,761·01	1,221·01	2,013·96

Per Acre		*Per Acre per Year*	
Clearing	160·09		4,995·98
Planting	111·00	52·18	
Upkeep (3 years)	156·55	8·85	
Watchman	26·54		

TABLE V.

Hedigalla 1944 Clearing—14 Acres

	(1943) Rs.	1944 Rs.	1945 Rs.	1946 Rs.	Total Clearing Rs.	Total Planting Rs.	Total Upkeep Rs.
Survey	104·15	—	—	—	104·15	—	—
Felling and Clearing ...	793·76	19·47	—	—	813·23	—	—
Lining	16·70	4·11	—	—	20·81	—	—
Holing	365·28	259·20	—	—	624·48	—	—
Dynamiting	62·62	52·07	—	—	114·69	—	—
Filling Holes	115·77	69·30	—	—	185·07	—	—
Trenches	212·66	64·44	—	—	277·10	—	—
Leader Drains	51·62	—	—	—	51·62	—	—
Budded Stumps	—	612·60	—	—	—	612·60	—
Planting	—	53·47	—	—	—	53·47	—
Supplying	—	—	—	6·19	—	—	6·19
Weeding	199·45	264·30	333·88	204·41	—	199·45	802·59
Illuk and Mikania ...	—	—	—	—	—	—	—
Cover Crops	—	—	22·69	38·80	—	—	61·49
Lopping Covers	—	—	1·70	2·87	—	—	4·57
Fencing	278·58	—	—	—	278·58	—	—
Roads and Paths ...	8·59	—	28·19	3·60	8·59	—	31·79
Manures	—	—	32·54	86·32	—	—	118·86
Tools	114·27	19·95	—	—	134·22	—	—
Labels	—	20·67	—	—	—	20·67	—
Baskets	—	344·93	—	—	—	344·93	—
Temporary Lines ...	27·95	—	—	—	27·95	—	—
Terracing	—	—	—	—	—	—	—
Repairs and Trenches ...	—	—	301·37	75·51	—	—	376·88
Pests and Diseases ...	—	6·75	11·63	1·51	—	—	19·89
Budding and Attention ...	—	—	24·47	22·63	—	—	47·10
Watchman	—	—	145·47	65·84	—	—	211·31
	2,351·40	1,791·26	901·94	507·68	2,640·49	1,231·12	1,680·67

Costs per Acre		*Per Year per Acre*	
Clearing	188·61		5,552·28
Planting	86·51		
Upkeep	104·96	52·48	
Watchman	15·09	7·54	

TABLE VI.

Hedigalla 1945 Clearing—25 Acres

	1944 (5 acres) Rs.	1945 (20 acres) Rs.	1946 Rs.	Total Clearing Rs.	Total Planting Rs.	Total Upkeep Rs.
Survey	36·46	—	—	36·46	—	—
Felling and Clearing	284·88	917·48	—	1,202·36	—	—
Lining	12·43	118·37	—	130·80	—	—
Holing	375·60	1,023·09	—	1,398·69	—	—
Dynamiting	68·89	210·64	—	279·53	—	—
Filling Holes	170·98	245·18	—	416·16	—	—
Trenches	165·71	127·73	—	293·44	—	—
Leader Drains	30·72	17·93	13·46	48·65	—	13·46
Budded Stumps	—	928·50	—	—	928·50	—
Planting	—	122·12	—	—	122·12	—
Supplying	—	—	99·97	—	—	99·97
Weeding	468·74	180·22	612·36	468·74	—	792·58
Illuk and Mikania	—	—	—	—	—	—
Cover Crops	—	—	185·36	—	185·36	—
Lopping Covers	—	15·78	41·73	—	—	57·51
Fencing	165·82	—	—	165·82	—	—
Roads and Paths	5·11	—	22·06	5·11	—	22·06
Manures	—	18·58	75·41	—	—	93·99
Tools	50·00	52·79	—	102·79	—	—
Labels	—	—	—	—	—	—
Baskets	—	452·95	—	—	452·95	—
Temporary Lines	—	—	—	—	—	—
Terracing	—	—	—	—	—	—
Repairs and Trenches	—	—	699·79	—	—	699·79
Pests and Diseases	—	—	22·15	—	—	22·15
Budding and Attention	—	—	24·76	—	—	24·76
Watchman	—	—	131·68	—	—	131·68
	1,835·34	4,431·36	1,928·73	4,548·55	1,688·93	1,826·27
						131·68
						8,195·43

Per Acre	
Clearing	181·94
Planting	67·56
Upkeep (1 year)	72·25
Watchman	5·27

TABLE VII.

Hedigalla 1946 Clearing—16 Acres

		Total Clearing Rs.	Total Planting Rs.	Total Upkeep Rs.
Survey	—	—	—	—
Felling and Clearing (Contract) ...	1,800·00	1,800·00	—	—
Lining	16·28	16·28	—	—
Holing	522·89	522·89	—	—
Dynamiting	59·57	59·57	—	—
Filling Holes	131·95	131·95	—	—
Trenches	357·15	357·15	—	—
Leader Drains	—	—	—	—
Budded Stumps	264·62	—	264·62	—
Planting	71·98	—	71·98	—
Supplying	—	—	—	—
Weeding	160·59	—	160·59	—
Covers	45·39	—	45·39	—
Lopping Covers	17·31	—	—	17·31
Fencing	—	—	—	—
Roads and Paths	7·03	7·03	—	—
Manures	59·93	—	—	59·93
Tools	85·77	85·77	—	—
Labels	—	—	—	—
Baskets	340·51	—	340·51	—
Temporary Lines	—	—	—	—
Repairs to Trenches	—	—	—	—
Pests and Diseases	—	—	—	—
	3,940·97	2,980·64	883·09	77·24

Per Acre

Clearing	186·29	
Planting	55·19	
(Upkeep)	4·83	60·02

II. REPLANTING OF OLD RUBBER

The conditions facing the Ceylon Rubber Industry today lend renewed force to the arguments detailed by E. W. Whitelaw in his book "Practical Replanting of Rubber" ("Times of Ceylon," 1938), and have been emphasised in the report of the 1947 Rubber Commission. Each year the continued existence of large areas of old seedling rubber exerts an increased braking force on attempts by the industry to meet the strenuous competition of all rubber producers in a world market which shows as yet little signs of large scale expansion; in fact the latest developments in world economic conditions seem likely to lead to a diminution of market capacity. There is no doubt that a considerable proportion of Ceylon rubber areas cannot face these adverse conditions and must change over to some other crop, but the remainder still have hopes of being able to continue in production. To do this it seems essential that they accelerate the replacement of old seedling rubber by better material, either by high yielding clones or by good types of clonal seedlings. While this capital expenditure is being made there must of necessity be a fall in total production from these estates, until the time when the new fields come into tapping and full production at an estimated time of 10 years after planting, by which time we can only hope that markets will have become stabilised at remunerative rates. The only alternative to this policy would appear to be to place the doubtfully economic estates on a care and maintenance basis, pending better market prices, but in that case they would still not be able to take full advantage of the better prices, as the old rubber would still be low yielding. Therefore it is considered that the present is the time to make careful enquiry into the economics of each estate, and to make the all-important decision whether to replant or not. If it is decided to replant then the programme should be designed to replace all old rubber in the shortest possible time. It is naturally impossible for anyone to make a reliable forecast of what market conditions will be in ten years' time, but judging from the past, periods of slump conditions are succeeded by periods in which it is possible for estates to make reasonable profits, though in view of the new factor of synthetic rubber, it is exceedingly unlikely that "boom" conditions will ever occur in the future. In comparison with other producers the Ceylon rubber industry is at a severe disadvantage with its high costs of labour, lower production per acre and per unit of labour: this is an additional reason why it is especially important that the Ceylon estates should be replanted with the very best material available, if they are not to fall completely out of production.

The operations in connection with the replanting of old rubber are well known to every experienced planter, and it is therefore unnecessary to repeat them here. The following notes are therefore limited to modern modifications of the standard practice, designed to minimise costs. The table of costs has been summarised from those supplied by a representative sample of estates, supplemented by our experience on the stations of the Rubber Research Scheme.

Felling Old Rubber.

The costs given under this item in the Table are based on the normal Ceylon method of cutting the main roots and felling by elephant, and no allowance has been made on the credit side for sale of timber and firewood. In respect of such sales each estate has its own special conditions—some can even make a profit from such sales, while others find no outlet for the material.

An alternative method of dealing with the old rubber trees is to poison them with Sodium Arsenite. In Malaya it was found that on an average

about ½ lb. of sodium arsenite per tree was required for effective poisoning. Details of the methods advised have been given in the combined 1st and 2nd Quarterly Circulars for 1947, page 41. Based on the results of a small scale experiment on sodium arsenite poisoning at Dartonfield, about ½ cwt. of sodium arsenite will be required per acre of about 100 trees at a cost of Rs. 37·50. Labour up to 6 working days for the preparation and application of the poison will bring the total cost per acre to approximately Rs. 45/-. When this method is used there can be no return from sale of firewood and timber as the wood is contaminated with arsenic.

Experiments are now in progress on what may prove to be a less troublesome and cheaper method of killing old rubber trees, by spraying the trunks with Diesel Oil. So far the results have been very variable, and it is obvious that we have not yet discovered the best dosage nor the most efficient method of application.

In neither of the above methods is it necessary to cut or fell the trees, which are merely left to decay as they stand. Using the normal Ceylon method of clearing by elephant, experience has shown that where the costs cannot be recovered from sales of firewood, it is not necessary to cut up and remove the trunks and larger branches of the felled trees. The smaller branches and bushwood are best stacked and burnt. The remaining trunks with their large branches can be left to rot where they fell, except where they have to be pushed away to allow of holing operations for the new planting. In any case it is advantageous to leave the trunks close to their own sites, as we have now had experience of new sites of *Fomes* root disease starting up on the old rubber roots left in the soil. In several cases these sites were first discovered by the growth of *Fomes lignosus* on the trunks of individual felled trees, instead of the normal flora of wood rotting fungi. When the soil around the base of these trees was opened up it was found that the old roots were covered with the *Fomes* mycelium. In fields from which all timber from the old rubber has been removed, the first sign of *Fomes* root disease is the death of young plants of 9-18 months of age, and at this stage the individual patches of disease are considerably larger than those detected at an earlier stage in fields still having the old trees remaining *in situ* and used as "indicators." It appears that in old rubber fields there may often be quiescent *Fomes* attacks, which are never discovered, even at the time of felling the old stand. The mycelium of the fungus spreads underground over the dying roots of the felled trees, and early discovery of the sites will consequently reduce eradication expenditure.

Poisoning the old stand with arsenite will not affect any *Fomes* that may be present, and it is therefore necessary to make repeated inspections of the poisoned trees to see that all cases of *Fomes* infection are properly dealt with. In this case however there is little danger of enlargement of the infection sites, as it is very unlikely that the fungus is able to infect any wood containing the poison, but merely completes its development on wood already infected. The danger from root disease in replanted areas on the whole seems to be greater than that experienced when jungle was cleared for new plantings, and it is wise to take all precautions possible without appreciably raising the costs of the new plantings.

B. Lining Out.

At the outset important decisions have to be made: firstly, whether budded clones are to be planted, or clonal seedlings, secondly, the density of planting, which is largely dependent on the first decision, and thirdly, whether square or contour planting is to be adopted.

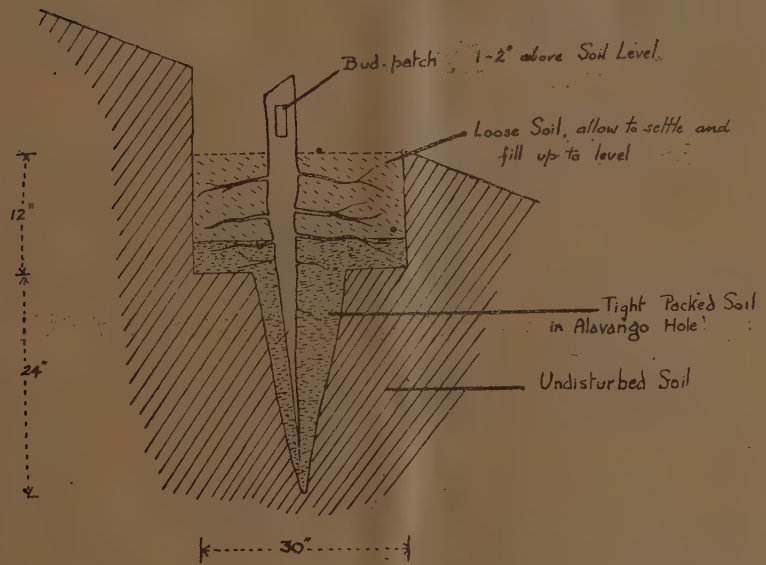
On the first point, a general account of present knowledge of clonal seedlings has recently been published as Advisory Circular No. 26, while recommendations as to suitable clones are given in Advisory Circular No. 20. With respect to density of planting, present views are that budded rubber should be planted at 140-180 to the acre, while clonal seedlings require 220-260 plants per acre. In both cases the ultimate object is a stand of about 140-160 of the best trees per acre at the time they are ready for tapping, that is by the 6th year for budded rubber and the 5th year for seedlings. Further casualties from brown bast, wind damage, root disease, etc. will reduce the stand to 120-140 trees per acre by the time they can be considered mature at 12-15 years of age. It is generally agreed now that mature stands of 90-100 per acre are too low to provide the best results, and that the old policy of planting 120-140 plants per acre necessarily resulted in these low stands. There are many opinions on the question of square planting as against contour planting: in all experimental plantings the Rubber Research Scheme is now using the former method as lending itself more readily to experimental procedure and resulting in a more uniform stand. Even on steep hill sides anti-erosion trenches or pits can be fitted in fields square planted, without undue trouble. All these experimental plantings have been made on land newly opened from jungle, so that no complications have arisen from old anti-erosion measures. In most areas on estates now due for replanting, such anti-erosion systems already exist and in order to minimise costs it is essential that the new plantings should fit these if they are reasonably efficient. In any case one must aim at rather closer planting than in the past, and at obtaining as uniform a stand as may be possible. The only exception to high planting density occurs in districts such as Ratnapura, where drying of the trees is a major factor in annual production and high stands are likely to reduce the number of tapping days per annum, especially with a dense-crowned clone such as TJ. 1.

Holing.

It is doubtful whether the present expenditure on excavation of large rectangular holes is necessary or is recouped from any advantage in growth. The essentials are that the planting hole shall accommodate the root system of the young plant, and enable it to start growth rapidly. A few months after planting the young feeding roots of the new crop will have grown beyond the edges of even the present large holes, while the tap root will grow in any case downwards until it meets with some large obstruction it is unable either to penetrate or to avoid. Even with present holes dug to 3 ft. in depth there is the possibility of encountering more or less solid rock a few inches deeper, while observations made on old seedling rubber now being replaced, indicates that 3 ft. to 3 ft. 6 ins. in depth provides sufficient anchorage even for large trees, as where the tap root is unable to penetrate deeper, the larger lateral roots take over the function of anchorage fairly efficiently. Therefore our evidence indicates that round or square holes about 24"-36" inches across and 1 foot deep are sufficient to accommodate the lateral root system of a young tree at the time of planting, with a central hole to 3 ft., made with a crowbar, to take the tap root. Where rock is encountered, it may be necessary to make more excavation and even to dynamite the bottom of the hole, as in present practice, but there is little doubt that some money could be saved from present expenditure on holing.

Experiments have shown that there is no advantage in filling holes with only surface soil collected in the vicinity over filling them merely with the soil originally excavated from them, with the addition of a little phosphate manure. The Diagram I. shows a section of the new type of hole with a budded stump correctly planted in it. When planting is to be done

on a severe slope, as is the case with that at Dartonfield and Hedigalla stations of the Rubber Research Scheme, each filled hole is levelled off as a small platform, with the budded stump planted with the bud 1-2" above the hole surface. This results in an erect bench at the back of each hole, but is preferable to planting with the bud 1-2" above the average gradient level, when erosion might result in the " elephant foot " of the union eventually being too high above final ground level to permit of convenient tapping at the top of the panel. This is illustrated in the diagram which also shows the suggested modified hole to save expense :—



Planting.

Budded Stumps.—Great care should be exercised in the uprooting of these from the nursery and in planting them in the field, to minimise damage to both tap root and laterals. It is especially important not to damage the lateral roots at their junction with the tap root—if damage occurs here the stumps will not grow and must be supplied later with new plants. To obtain rapid and good growth of the bud shoot it is obvious that the root system of the stock must be able to function properly at the earliest possible moment, which is after new roots have been formed on those of the stump when planted. When planting the stumps in the field the holes should be re-excavated to about 8-10 inches to accommodate the roots of the stump, with a central deep hole to take the tap root. Then after placing the stump in the hole the soil should be pressed against the tap root all the way down to the bottom by means of a crowbar and leverage of soil towards the root, and only after this is done should the re-filling of the hole be commenced. As the hole is gradually filled up the soil should be closely packed around each layer of roots ; this packing of the soil cannot be done merely after completely filling the hole as then damage will almost certainly occur to the lateral roots in the process of consolidation.

Protection baskets will be necessary to keep the young bud shoot from injury and to shade the union of scion and stock. Where damage from vermin is anticipated the baskets can be sprayed afterwards with a mixture of 1 oz. of nicotine sulphate (40%) to 1 gallon of water, with addition of lime and flour paste to give a suitable consistency. The smell of the nicotine appears to act as an efficient repellant to rats and bandicoots, even though these are rarely poisoned. The poison can be limited to the three or four rows next the boundary of the new field.

It is a great advantage to plant as early as possible in the S.W. monsoon season, preferably in April or May, so that by the time the inevitable attack of *Phytophthora* occurs in August, the young shoots may be as fully developed as possible. In the case of stumps planted after July each year this trouble does not arise as *Phytophthora* is of comparatively rare occurrence in the N.E. monsoon season.

Clonal Seedlings.—As the seed is relatively expensive, especially if imported, the old method of planting 3 or 4 seeds at stake is wasteful in a field of high density. It is considered preferable to germinate the seed in a nursery, and either to plant the germinated seed direct into the field, or to plant them singly into baskets of good soil, transferring the baskets 4 to 8 weeks later to the field. When time permits, the germinated seed can be planted in a nursery and the plants uprooted for transplanting to the field 8-18 months later, after cutting back and defoliation, and dipping the cut end into melted wax. This last method was used at Dartonfield in 1947, and the stumps about 5 ft. high gave 100% stand, so that where the programme can be adjusted to use this method it is likely to prove the cheapest of all, avoiding expense on baskets, protecting baskets and supplying.

Weeding and Cover Crops.

Most areas now due for replanting are already established under legume covers, usually *Pueraria* or *Desmodium*. Even where felling results in increased growth of weeds, a few rounds of weeding should be sufficient to enable the cover gradually to re-establish itself and keep weeds under partial control. An area of 3 ft. radius must be kept clean around each young plant, to avoid excessive competition with the cover crop, and if the latter is *Pueraria* a larger clear space is required to prevent it climbing up the young plants. After 4-5 years the clean area is no longer required as the rubber can then fend for itself and the development of its canopy will control the growth of the cover crop.

Where an area of old rubber is under a grass and weed cover two possibilities are open: either to control this vegetation by repeated slashing and to wait until the canopy reduces its luxuriance sufficiently to render its replacement by a legume cover reasonably cheap, or to destroy it by weeding and burning, and replace by a legume cover at the start. Present information does not indicate which alternative is best or cheapest in the long run.

In the case of old fields killed off by poisoning, it is probably best to replace the weed cover at the time of poisoning, while there is still controlling shade from the old trees, which will also assist in erosion control. In all new fields it is vitally important to establish and retain a complete cover of vegetation at the earliest possible moment, to prevent extensive erosion of surface soil.

General.

The table appended deals with the costs of clearings made in the 1945-46 season, the last year for which complete figures are available. Since then wages have risen by about 5%, and costs of all other articles by at least this amount. From figures so far available it appears that average costs of replanting have now risen to a figure somewhere between Rs. 400/- and Rs. 440/- per acre for the clearings made in 1947, and there is at present no sign that this upward trend of costs will halt or be reversed in the near future.

TABLE

Replanting Costs for 1946 Clearings.
Costs per acre for Complete First Year.

Operation	Lowest Rs.	Highest Rs.	Average Rs.	Notes
Survey	1·94	5·40	3·39	
Felling and Clearing	45·26	234·17	121·67	
Soil Conservation	7·56	35·83	24·33	
Lining Out	1·81	9.77	5·53	
Holing	40·30	72·10	49·11	
Filling Holes	16·20	40·01	31·16	
Dynamiting	—	16·48	1·50	
Planting Material	6·94	38·76	21·17	
Planting	3·00	20·84	11·40	
Cover Crops	—	22·34	6·94	
Weeding and Cover Control	—	—	—	
Roads	28·35	105·78	57·15	
	—	27·20	20·03	Average on estates where roads were made.
Paths and Steps	—	—	—	
Fencing	—	14·00	5·09	
Manures	—	63·02	24·74	
Tools	2·79	25·44	13·31	
Baskets	—	40·04	17·53	
Pests and Diseases	—	10·72	7·39	
Supervision and Contingencies	—	69·04	5·70	
	*	46·97	14·64	*Many estates do not include this item in their clearing costs.
		—	—	
		—	—	
Totals of above	154·15	897·91	441·78	
Actual Total Costs*	343·63	565·24	365·00	*Obtained from estate returns, making no allowance for sale of firewood, etc.

It will be noted that major savings have been effected by most individual estates on the average costs of some of the operations, as reflected in the difference between the average total of all operations, Rs. 441/78 and the actual average total estate costs of Rs. 365/-. The latter figure is comparable with that given by Mr. Farquharson to the Kalutara Planters' Association in 1938 of Rs. 180/-.

III. IMPROVED PLANTING MATERIAL

The Dutch workers in the Netherlands East Indies have the credit for originating work on the production of improved types of planting material by selection of individual trees for propagation as budded clones and also by first attempts to obtain seed of higher quality than previously available by collection from parents of known high performance. By about 1926 their results with the new budded clones were so startling that they were copied in both Ceylon and Malaya, first by direct importation into these countries of the Dutch clones and then by large scale investigations of the old seedling rubber available on the spot. In the boom which developed during the succeeding 10 or 15 years in production of new clones, it would appear that investigation of the possibilities of improved seedling families tended to be neglected. Large numbers of clones were put on the market, but have now been reduced to a very few, which have become standard in almost the whole of the East. In Ceylon the very large numbers of local trees investigated during the period 1926 to 1936 have now resulted in only three local clones of any importance, HC. 28, Wagga 6278 and MK. 3/2. All others have virtually disappeared and are no longer recommended for planting. It has thus taken the Rubber Research Scheme practically twenty years of very detailed and laborious work to eliminate the remainder of local clones for one reason or another. The same story is applicable to Malaya and the Dutch East Indies.

Notes on Clones in Ceylon.

TJ. 1.—A most reliable clone for the low country in Ceylon, but in other districts is probably not so outstanding. In Ratnapura, for instance, it suffers from the serious disadvantage that its very heavy foliage hinders the drying of the panels in that very wet climate, with the result that as compared with other clones a serious number of tapping days is lost, and results in a lower yield per acre per annum.

In the drier parts of Ceylon the yield of this clone is often surpassed by that of others.

In former days TJ. 1 gathered a bad reputation for susceptibility to Brown Bast, but later experience rather indicates that this was largely due to excessively heavy tapping systems on the young trees, mainly due to war-time demands. There is now evidence to show that the clone will pass safely through the danger period of the first four tapping years if tapped on S/2 d/3, system and in most cases even when tapped on the normal S/2 d/2. It is important not to strain the trees excessively during the early years of tapping, and experience on many estates shows that yields of the order 300, 500, 700, 900 lbs. per acre for the first four years respectively are reasonably safe, but that yields much in excess of these almost inevitably lead to a sudden and severe outbreak of Brown Bast.

TJ. 1 tends to winter earlier than many clones and so often escapes severe damage by *Oidium*, but any areas delayed in wintering may be completely defoliated. Other defects of the clone are its tendency to pre-coagulation of the latex, a rather high amount of scrap, and especially under present market conditions, its yellow latex which causes great reduction in the prices obtained from sole crepe made from it.

TJ. 16.—This clone is less vigorous than TJ. 1 and in areas of poor soil may prove very slow in growth and be delayed in reaching tappable girth. It tends to winter late and hence is usually badly attacked by *Oidium*. In Ceylon it is still recommended for the drier areas, where its yield has proved satisfactory, but in the wet low country it cannot be considered a serious rival to TJ. 1.

GL. 1.—The lighter crown of this clone as compared with TJ. 1 renders it more resistant to wind, and also enables the trees to dry more rapidly. Hence it is recommended for wet areas such as Ratnapura. It may on occasion be particularly liable to Brown Bast, and for that reason it is strongly recommended that tapping for the first 3 years be on the S/2 d/3 system. Yields even on this reduced tapping intensity are good and there is some evidence to favour the continuance of this system for the whole life of the trees. The clone usually winters early, but in late seasons it may suffer severe damage from *Oidium* attack. It needs reasonably good soil to make satisfactory growth. On one or two estates it has suffered from attacks of flying foxes, which seem to have a partiality for its foliage. It appears from further experience that these attacks are very localised and seasonal and the former scare on this subject has now died down to a large extent.

PB. 86.—This clone has recently come into favour with many planters in the low country. Its foliage is less dense than that of TJ. 1, with the result that the cover crops are not killed out by its shade, as often happens with TJ. 1 from about the 7th to 10th year, leaving the soil practically bare and liable to severe erosion. So far, however, the yield records of PB. 86 have not proved as good as those of TJ. 1, though as yet there are rather few areas in full tapping, to use as a basis for comparison. Growth is also rather slower than that of TJ. 1, and may account for the yield differences observed. Though apparently less susceptible to *Oidium* attack than the preceding clones, it cannot be classed as at all resistant, and as the present fields get older, with the usual delay in wintering of mature trees, the annual attack may get worse. Trouble may be experienced from Pink Disease on this clone, which seems more susceptible to this fungus than TJ. 1.

MK. 3/2.—This is a vigorous clone and yields well; it is resistant to wind if given sufficient anchorage. Its most serious drawback is its liability in wet weather to *Phytophthora* disease of the tapping panel, and the exceptionally wet period of August, 1947 caused the old canker wounds at Nivitigalakele to re-commence activity, in spite of the regular use of disinfectants. It is therefore extremely important to prevent initial infection by this disease on MK. 3/2, or else serious trouble may be experienced years later when the renewed bark is due for tapping. The liability to other *Phytophthora* diseases such as branch canker, etc. does not seem to be worse than in other standard clones.

WG. 6278.—Although this local clone has been on the list of Rubber Research Scheme general recommendations for a number of years, hitherto records of its performance have been very limited; and it is not yet possible to make a final assessment of its value as compared with TJ. 1. The trees are tall with a narrow light crown, hence they are not liable to excessive wind damage, but they will not grow well in exposed situations. Growth and thickening of the trees is rather slow so that tapping may be delayed.

HC. 28.– Growth is very vigorous, and yields good. It suffers from the disadvantage of fluting of the stem, but some estates have reported that this has been over-stressed and that they have no difficulty in tapping the trees. The trees winter late, but though *Oidium* attacks the leaves and develops in profusion on their surface, leaf fall is markedly less than with most other clones. Experiments are being designed to assess the value of this character, by crown budding HC. 28 on to other clones and observing the incidence of *Oidium* as correlated with eventual yields.

WAR. 4.—Reports from estates showed this clone to give outstanding growth in early years, but in experimental trials at Nivitigalakele it has

been surpassed in this respect by a number of other clones, including PB. 6/50 and HC. 28. Its early yields have been about those of the control TJ. 1, and where the latter is known to do well there would seem to be no advantage in changing to WAR. 4. Its performance in drier districts is not yet known.

*PR.*107.—Early growth in experiments at Nivitigalakele has been rather less than that of TJ. 1, but yields are of the same order as the latter clone, though it is yet far too early to pronounce on the relative value of the two.

PIL. B. 84.—This clone has been planted in Ceylon mainly on account of its good reputation in Malaya, where it has proved very vigorous on relatively poor soil. At Nivitigalakele Experiment Station it has recently come into tapping, with results so far of the same order as those of TJ. 1.

BD. 10.—For a number of years this clone was marked down as being liable to excessive wind damage and having uneven bark renewal. These characters may have been over-stressed, for in Ceylon, though there may be some fluting of the stem towards the base, no great difficulty has been experienced in tapping. The clone does relatively well in areas of poor soil and has there beaten BD. 5 and TJ. 16. Direct comparison with TJ. 1, now the standard Ceylon clone, has not been possible in experiments laid down in the past.

BD. 5.—This clone is now known to be particularly susceptible to all forms of *Phytophthora* attack, on foliage, twigs, branches and tapping panel, and at all stages of growth. For this reason it is no longer recommended, in spite of its having given good yields on several estates. In up-country dry districts, liable to severe *Oidium* attacks, it is not a success.

PB. 186.—Few records of its performance on estates have so far been available, though those received have indicated satisfactory but not outstanding yields. Foreign reports have spoken of thin and hard bark on this clone, requiring very careful tapping, but so far these characteristics have not been reported in Ceylon.

A number of more recently developed clones are under careful observation on the experiment stations of the Rubber Research Scheme, and the following list includes some of the more promising of these :—

LCB. 1320, PB. 6/50, PB. 5/139, AV. 255, RRI. 511, RRI. 514, RRI. 506, RRI. 513, and a number of new NAB. clones derived from Tjikadoe seedling trees.

It will be yet a matter of four or five years before reliable results will be forthcoming from the small-scale trials so far laid down with these varieties, but steps are now being taken to arrange for their trial on a larger scale.

It will be evident to all planters that the selection and testing of new clones is a very slow process and it would involve considerable risk to attempt to speed it up unduly, especially as we have at present a few known reliable clones available in quantity in Ceylon. To make rapid changes to new clones merely for the sake of novelty would in all probability lead estates into serious losses, if these were suddenly planted on a large scale. At the same time estates must be encouraged to make experimental plantings

of the newer clones, as it is only from such plantings that new information of general value can be obtained in the future. Under present conditions the stages of testing involve :

(*a*) small-scale tests by the Rubber Research Scheme (7 years),

(*b*) larger scale tests of varieties selected from (*a*) by the Rubber Research Scheme (7 years),

(*c*) estate trials on experimental plantings (7 years).

To some extent (*b*) and (*c*) can proceed side by side in the case of very outstanding clones, but it will be realised that roughly 15 years must elapse before a new clone is likely to reach the stage at which a general recommendation for its planting on a large scale can be given authoritatively.

Material for Stocks.

Although there is evidence that the stock of a budded plant exerts an influence upon the ultimate yield, it has so far proved virtually impossible to obtain any exact evaluation of this effect. In Java it has been recommended that illegitimate seedlings of such clones as TJ. 1, TJ. 16, BD. 5 and AV. 163 should be used wherever possible for stocks. Here in Ceylon TJ. 16 is a very poor seeder, and the only seed likely to be obtainable in sufficient quantity is that from TJ. 1. The essential in any stock is vigour of growth, presumably correlated with rapid development of an extensive root system. Hence seedlings of TJ. 1 should prove good from this aspect, judging by its general vigour as a clone. But here the question arises as to whether, as the old rubber areas gradually disappear in Ceylon, it might not prove as well to plant the seedlings of TJ. 1 as clonal seed, wherever they can be obtained from suitable areas on the estate. From present evidence it could not be recommended to any estate to purchase seed of TJ. 1 to use merely as stocks, but if seed is available at no cost save that of collection, then it is likely to be an improvement on stock material collected haphazard from old seedling rubber. The position at present is that estates should make use of the best material available for stocks, without making any additional or special expenditure to obtain it.

When ordinary unselected seed is planted to obtain stocks, it is essential that a very rigorous selection be made in the nursery, to bud only the most vigorous individuals, and the same selection should be exercised even when the stock nursery is planted with TJ. 1 seed, which is liable to throw a proportion of slow growing or weakly plants of no value.

Clonal seed is too valuable at present to waste on stocks.

Seedling Families—Clonal Seed.

A summary of present information and opinions on this class of planting material has recently been published as Advisory Circular No. 26. All that is necessary here is to repeat that this material shows great promise of providing the standard clones of the future, and that, in common with breeding work on most other plantation crops, progress in the future is likely to be made by a dual method of selection of high-yielding clones, and inter-breeding of these to produce a clonal seedling population from which a new series of clones can be isolated. At present it would seem that the possibilities of the old seedling rubber have been exhausted, as far as clone isolation is concerned, and we now have to await tapping experience on the areas of clonal seedlings now being planted, before we have much hope of any further advance of any large proportions. The most recent evidence from abroad tends to indicate that seedlings from high-yielding clones such as TJ. 1, PB. 86, etc. tend to reproduce the general

yield performance of their parents, while so far crosses between such clones seem to show promise of better performance than "selfed" seed. In view of the inherent variability in all clonal seed, it would be rather too much to expect the progeny to give yields exactly as high as their parent clones, but it appears so far that the difference is not likely to prove very important while the seedlings have advantages in more rapid growth and thicker bark. With a proper degree of selection of the final stand, according to the recommendations given in the Circular referred to above, there is no reason at present to anticipate any serious failures in fields planted with clonal seed of the quality now available in Ceylon.

COLOURED SPOTS IN CREPE RUBBER AND SOLE CREPE

By EDGAR RHODES

The rubber may contain spots which may be of different colours—red, green, yellow, orange, blue, violet or black.

Spores of different fungi and bacteria are present in the air, and come into contact with rubber at all stages of manufacture. They are invisible to the eye and are present on hanging lace and therefore on and inside sole crepe. If the spores do not develop no trace of them is seen. If they do develop they produce spots of various colours according to the kinds of spores present.

The development of spots is most favoured by the presence of dead air in a warm moist condition and if suitable conditions arise, spots may develop at any time. They frequently develop in the hanging lace for one or more of the following reasons:—

(i) excessively long drying time with poor air circulation in the drying house, or when laces are hung one on top of another producing thin films of dead wet air between "contacting" laces;

(ii) the use of too great an amount of sodium bisulphite which causes slow drying.

They may also be found weeks after the manufacture of an apparently perfect crepe or sole crepe if cases are subjected to moist conditions as by :

(i) standing on cement floors for several days;

(ii) storage in damp warehouses;

(iii) exposure to rain or sea water; or

(iv) conveyance in a warm damp ship's hold.

Thus it is possible that spots may be found on or in the rubber either before actual shipment, immediately upon arrival at destination or later.

The aims should therefore be:

(i) to dry the laces quickly and singly;

(ii) to store loose rubber on the estate for the shortest possible time and under the driest possible conditions;

(iii) to dry all boxes thoroughly before packing;

(iv) to store all boxes under the driest possible conditions. Direct contact of boxes with cement floors or between box and box is dangerous. Boxes should stand on battens, there should be

battens between each tier of boxes and the next, and there should be vertical channels between box and box to permit air circulation through and round the stack;

(v) to store for the shortest possible time before shipment;

(vi) to do everything possible to avoid direct exposure to rain or sea water during transit to port or from warehouses to ship.

Research Laboratories,
Dartonfield,
Agalawatta, 15-12-47.

PLANTING NOTES

Sources of Clonal Seed.

As many of the earlier plantings of budded rubber in Ceylon are now coming into tapping, and also into seed production, in view of future heavy replanting programmes on most estates, the question will arise as to possible sources of clonal seed. Recently a number of additional approved sources have been added to the list published by the Rubber Controller, but it is probable that many other areas suitable for production of good quality seed exist in Ceylon. Estates are requested to submit plans of areas which they consider suitable, and if finally approved they can be added to the Rubber Commissioner's lists. There is likely to be a greatly increased demand for this type of planting material in the next few years and it is quite probable that existing approved gardens may not be able to cope with demands, especially in a season of heavy attack by *Oidium* or *Phytophthora* diseases.

All plans should be sent in the first instance to the Botanist, Rubber Research Scheme for his comments; if found suitable for official approval they will be forwarded to the Rubber Commissioner. Plans should show not only the clones planted in the fields submitted for approval but also details of all adjoining rubber within 100 yards of the boundaries of the seed area. Even though some areas may be small and not capable of providing appreciable quantities of seed for sale, they may produce sufficient for use for replanting programmes of their own estate. Information is now coming to hand which tends to show that crosses between many of the standard high yielding clones are quite good as clonal seed, and collections made on estates themselves may save something of replanting costs, as a substitute for outside seed which is expensive.

C.G.H.

1st December, 1947.

Clonal Seeds.

The following varieties of clonal seeds are on the Rubber Controller's list of approved material for new planting:—

Foreign Sources.

TJ. 1 ... ... From No. 6 Block of 1929 clearing, Ambadi Estate, Kulasekeram, near Martandam. South Travancore.

BD. 10	From No. 5 Block of 1929 clearing, Ambadi Estate, Kulasekeram, near Martandam, South Travancore.
Prang Besar Isolated Gardens Seed	From Prang Besar Rubber Estate, Ltd., Kajang, Malaya, Plots C, D, E, F, G and H of the Isolated Seed Gardens. (Local Agents : Messrs. Harrisons & Crosfield, Ltd., P.O. Box 69, Colombo).
Tjikadoe Seed	From Isolation Seed Gardens, Messrs. Pamanoekan and Tjiasemlanden, Soebang, Java.
Clonal Seed of AV. 152, 163, 185 ...	From A.V.R.O.S., Medan, Sumatra.
Clonal Seed of (*a*) TJ. 1 and TJ. 16 ... (*b*) TJ. 1. AB. 157, BD. 5 and PR. 107 ...	From Mr. R. O. Moesi, Palembang, Sumatra.
Clonal Seed of (*a*) AV. 157, 166 ... (*b*) TJ. 1, TJ. 16 ... (*c*) AV. 157, 161, 166 ...	From Government Landbou, Batavia, Java.
Clonal Seed of Pil. A 44 and Pil. B 84 ...	From Pilmoor Estate, Malaya. (Local Agents: Messrs. Whittall & Co., P.O. Box 171, Colombo).
Clonal Seed of (*a*) TJ. 1 and TJ. 16 ... (*b*) TJ. 1 and TJ. 16 ... (*c*) PR. 103 and PR. 105 (*d*) PR. 103 and PR. 106 (*e*) PR. 103 and PR. 107 (*f*) PR. 103 and AV. 50 ...	From Mr. Tan Yam Hok, Batavia, West Java.
Mixed Clonal Seed of TJ. 1, BR. 2, Pil. B. 84, Lun. N. and PB. 86 ...	From Seed Garden E, Chemara Plantations, Ltd., through Messrs. Guthrie & Co., Ltd., Kuala Lumpur, Malaya.
Clonal Seed of TJ. 1 and AV. 157 ...	From Seed Garden B, Chemara Plantations, Ltd., through Messrs. Guthrie & Co., Ltd., Kuala Lumpur, Malaya.
Clonal Seed of AV. 157 and AV. 161 ...	From Seed Garden C, Chemara Plantations, Ltd., through Messrs. Guthrie & Co., Ltd., Kuala Lumpur, Malaya.
Clonal Seed of (*a*) AV. 157 and SAB. 24) (*b*) AV. 157 and AV. 49 ...	From Ulu Bernam Seed Gardens, Jendarata Estate, Teluk Anson, Malaya.
Clonal Seed of (*a*) AV. 157 and TJ. 1 (*b*) AV. 157 and BD. 10	From Kuala Bernam Seed Gardens, Jendarata Estate, Teluk Anson, Malaya.

Illegitimate Seed of PB. 86 and of PB. 25 ...	From Prang Besar Estate, Kajang, Selangor, through Messrs. Harrisons & Crosfield, Ltd., P.O. Box 69, Colombo.
Illegitimate Seed of TJ. 1 of AV. 152 and of BD. 5 ...	From Sogomana Estate, Lumut, Perak, Malaya.
Illegitimate Seed of TJ. 1	From Paya Lang Estate, Batu Anam, Johore, Malaya.
Illegitimate Seed of TJ. 1 ...	From Gadek Rubber Estate, Ltd., Kupang Division, Baling, Kedah, Malaya.
Illegitimate Seed of TJ. 1 ...	From Rajaghiri Estate, Bukit Rotam, K. Selangor, Malaya.
Illegitimate Seed of TJ. 1 of GL. 1 and of TJ. 16 ...	From Malayan Producers, Ltd., Changkat Changkat Kinding Estate, Tanjong Rambutan, Perak, Malaya.
Illegitimate Seed of TJ. 1 ...	From Chemara Plantations, Ltd., through Messrs. Guthrie & Co., Ltd., Kuala Lumpur, Malaya.
Illegitimate Seed of AV.49 of PB. 155 and of BD. 5 ...	From Paya Lang Estate, Batu Anam, Johore, Malaya.
Mixed Illegitimate Seed of TJ. 1, TJ. 16, BD. 5, BD. 10, AV. 49, BD. 2, TJ. 10	From Gadek Rubber Estate, Ltd., Kupang Division, Baling, Kedah, Malaya.
Mixed Illegitimate Seed of BD. 5 and BD. 10 ...	From Rajaghiri Estate, Bukit Rotan, Kuala Selangor, Malaya.
Mixed Illegitimate Seed of Pil. A. 44 and Pil. B. 85...	From Pilmoor Estate, Batu Tiga, Selangor, Malaya.

Ceylon Sources.

TJ. 1.	From Dalkeith Group, Latpandura.
TJ. 1	From Gonamaditta Block, Waljapola Group, Minuwangoda.
TJ. 1, 16	Mixed seed from approved areas of Blocks B, C and D, Pathregalla Estate, Pothuhera.
TJ. 1 ... ... PB. 25, 86	From Dias Peiris & Co. Seed Gardens, Milleniya Estate, Paragastota.

TJ. 1, 16	Illegitimate seed from approved area in Panigallakande Division, Yatadola Estate, Matugama.
BD. 5	
TJ. 1	From approved areas in fields Nos. 1 and 2 Frocester Estate, Govinna.
BD. 5	
GL. 1	
TJ. 1	Mixed seed from approved area in field No. 12, Frocester Estate, Govinna.
BD. 2, 5, 10	
DJ. 1	
CT. 88	
AV. 50, 80	
Borrowdale A and B Clonal Seed	From Borrowdale Estate, Meegahatenne.
TJ. 1, 16	From approved polyclone area in Kepitigalla Estate, Matale.
Pil. B. 84	
PB. 86	
TJ. 1, 8, 16	Mixed clonal seeds from approved area in fields B1, C1 and D1, Millakande Tea Estate, Mahagama.
BD. 2, 5, 10 ...	
PB. 23, 123 ...	
AV. 49, 50, 152 ...	
HC. 28	
TJ. 1	From Monoclone plantings on Mirishena Estate, Govinna.
BD. 5	
GL. 1	
HC. 28, 55 ...	From polyclone planting on Mirishena Estate, Govinna.
TJ. 1, 16 ...	
BD. 5, 10 ...	
PB. 86, 186, 6/50, 5/122 ...	
AV. 163 ...	
Moneragalla Mixed Clonal Seed	From approved area at Lower Lachesis Division, Moneragalla Estate, Moneragalla.
TJ. 1, 16 ...	From approved mixed clonal area, Nakkala Estate, Moneragalla.
PB. 86, AV. 157	
TJ. 1, 16 ...	From approved Monoclone plantings on Lower Division, Durampitiya Group, Getaheta.
BD. 5	
TJ. 1, 16	From approved area, Pussella Group, Parakaduwa.
TJ. 1	From approved areas on Lewella and Urumiwella Divisions, Urumiwella Group, Yatiyantota.

TJ. 1	From Isolated Seed Garden, Kiriporuwa Group, Yatiyantota.
PB. 86	
MK. 3/2	
WG. 6278	
MK. 1/3	
HC. 28	
BS. 3	
DBK. 1	
TJ. 1	
TJ. 1	From approved Monoclone plantings, Kiriporuwa Group, Yatiyantota.
PB. 86	
TJ. 1	From approved Monoclone plantings on Dandawa, Dandeniya and Hallina Divisions, Hunuwella Group, Opanaike.
PB. 86	
TJ. 16	
TJ. 1	From approved Monoclone plantings on Panana and Pallegama Lower Divisions, Pallegama Group, Warakapola.
TJ. 16	
BD. 5	
PR. 107	
MK. 3/2	
PB. 86	
... ...	From approved Monoclone plantings on Digdola, Watagoda, Doone Vale, Saumeresz, Peelidola, Ginidomini, Yatalamatta, Wattehena, Middle, 52-acre Divisions of Nakiadeniya Group, Nakiadeniya.
TJ. 1	
PB. 86	
MK. 3/2	
... ...	
TJ. 1	From approved Monoclone plantings of Higgoda Estate, Undugoda.
PB. 86	
GL. 1	
TJ. 1	From approved areas on Kalaella Division of Wellandura Estate, Kahawatta.
TJ. 16	From approved areas of Monoclone plantings on Nabuluwa No. 2 Division of Wellandura Estate, Kahawatta.
BD. 10	
BD. 10	From approved Monoclone plantings on Kalaella Division of Wellandura Estate, Kahawatta.
WG. 6278	
MK. 3/2	
TJ. 1, 16	From approved areas on New Mahawale Division of Wellandura Estate, Kahawatta.
TJ. 16	From approved areas, Panagama and Raddegoda Divisions of Delwita Group, Rambodagalla.
TJ. 16	From approved areas, Raddegoda Divisions of Delwita Group, Rambodagalla.
GL. 1	
BD. 10	
W. 4	
PB. 86	
Pil. B. 84	
TJ. 1, ...	

TJ. 16 TJ. 1 BD. 5	From Monoclone plantings on Block E Delmella Division, Halwatura Estate, Ingiriya.
TJ. 1	From approved areas of Monoclone plantings, Halwatura Estate, Ingiriya.
TJ. 16	From approved Monoclone planting Block 47 of Halwatura Estate, Ingiriya.
PB. 86	From approved Monoclone plantings, Blocks 84 and 85 of Halwatura Estate, Ingiriya.
TJ. 1 BD. 10	From approved Monoclone plantings, Blocks 100 and 102 of Halwatura Estate, Ingiriya.
WG. 6278 MK. 3/2	From approved Monoclone plantings, Blocks 103 and 104 of Halwatura Estate, Ingiriya.
PR. 017 Pil. B. 84	From approved Monoclone plantings, Blocks 105 and 106 of Halwatura Estate, Ingiriya.
TJ. 1 PB. 86	From approved Monoclone plantings (No. 1 Gardens) of Opata Estate, Kahawatta.
TJ. 1, 16	From approved Monoclone plantings (No. 2 Garden) of Opata Estate, Kahawatta.
TJ. 16	From approved Monoclone plantings (No. 3 Garden) of Opata Estate, Kahawatta.
PB. 86	From approved Monoclone plantings (No. 4 Garden) of Opata Estate, Kahawatta.
TJ. 1 PB. 86	From approved Monoclone plantings, No. 5 Division of Pelmadulla Group, Kahawatta.
TJ. 1, 16	From approved Monoclone plantings, No. 6 Division of Pelmadulla Group, Kahawatta.
TJ. 1	From approved area of Monoclone planting, Usk Valley Estate, Latpandura.
TJ. 1	From approved Monoclone plantings of Errabedde Estate, c/o Poronuwa Estate, Kahawatta.
TJ. 1	From approved Monoclone plantings of Galatura Estate, Kiriella.
TJ. 1	From approved Monoclone areas of Mipitiakande Estate, Yatiyantota.

We recommend that 80% of any area to be planted should be planted with proved material, and that not more than 20% should be used for testing unproved but promising new clones and seedling families, and also that not more than 5% of the area should be planted with any one type of unproved material. The list of varieties of clonal seed given above consists *entirely of unproved* types and none of them is recommended for use on a large scale.

Attention is drawn to the high tree-to-tree variations in yield shown by clonal seedling populations and it is strongly recommended that such material be planted at a density of not less than 250 trees per acre, so as to permit subsequent thinning out of the poor yielders. (See Rubber Research Scheme Advisory Circular No. 19).

July and August are the seed harvest months and it is suggested that orders for seed should be booked well in advance. Seed from Moneragala is available in January, not in July-August.

The Research Scheme has no clonal seeds for sale.

E.R.

RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the 84th Meeting of the Rubber Research Board held at the Secretariat, Colombo, at 2·30 p.m., on Monday, 28th July, 1947.

Present.—Mr. L. J. Seneviratne, C.C.S. (in the chair), Mr. H. E. Peries, C.C.S. (Deputy Financial Secretary), Mr. W. H. Attfield, Mr. W. P. H. Dias, J.P., Mr. A. M. Clement Dias, Mr. T. C. A. de Soysa, Mr. Noel de Silva, Mr. J. D. Farquharson, J.P., U.M., Mr. R. J. Hartley, Mr. A. D. Layton, Mr. R. C. L. Notley and Col. J. T. Young.

Dr. E. Rhodes, Director, was present by invitation.

Apologies for absence were received from Messrs. Thomas Amarasuriya, M.S.C. and Simon Abeywickreme, M.S.C.

1. **Minutes.**—Draft minutes of the meeting held on 12th May, 1947, which had been circulated to members, were signed by the Chairman on signification of members' assent that they were in order.

2. **Decisions by Circulation of Papers.**—

(*a*) *Board Membership.*—Reported that the Hon'ble Mr. G. E. de Silva, M.S.C., had been restored to membership by the decision of a majority of members.

(*b*) *Purchase of Latex.*—Agreed that latex be purchased for the manufacture of sole crepe when the Director considered that this could be done. The price to be paid was left to the Director's discretion.

Mr. W. H. Attfield and Mr. H. E. Peries came into the meeting.

3. **Smallholdings Committee.**—Recommendations made at meeting held on 7th July, 1947 :—

(*a*) *Rubber Instructors' Salary Scale.*—As recommended by the Committee, the creation of a senior grade of Instructor on a salary scale of Rs. 100×10—250 per month to which officers of special merit might be promoted after not less than five years' service was approved.

(*b*) *Deputy and Clerk for S.H.P.O.*

Deputy.—After considerable discussion the Committee's recommendation that a deputy S.H.P.O. be appointed on a salary scale of Rs. 300×25—600 per month was approved subject to alteration of the qualifications required of candidates.

Clerk.—The recommendation that an extra clerk be appointed to the Smallholdings Department was approved and it was agreed that the appointment should be made on the terms laid down for clerks.

The minutes were adopted.

4. **Experimental Committee.**—Recommendations made at meeting held on 15th July, 1947 :—

(*a*) *Visiting Agent's Report.*—

Bungalows.—The recommendation that a telephone extension be provided at the Estate Superintendent's bungalow was approved.

Factory and Machinery.—The recommendation that a new roll be purchased for the 26-inch smooth mill was approved.

Hedigalla Lines.—The recommendation that ramps and drains be provided for the following buildings was approved and a vote passed to cover their cost :

Quadruple Cottage at Hedigalla.
Conductor's Bungalow at Hedigalla.
Quadruple Cottage at Nivitigalakele.
Carpenter's Shed at Dartonfield.

The report was adopted.

(*b*) *Appointment of a Visiting Agent.*—The recommendation that Mr. W. A. Paterson be appointed V.A. was approved.

(*c*) *Hedigalla Cart Road.*—The recommendation that tenders be called for extension of this road by one mile in two stages of ½ mile each was approved.

(*d*) *Office Room at Hedigalla.*—The recommendation that an extra room be added to the proposed Rice and Tool Store at Hedigalla, to serve as an office room, was approved.

(*e*) *Estate Superintendent's application for leave.*—As recommended by the Committee, Mr. G. P. N. de Silva, Estate Superintendent was granted six weeks' leave from 11th August. It was left to the Director to arrange for a neighbouring Estate Superintendent to overlook the estates during this period.

(*f*) *Experimental K.P.*—As recommended by the Committee, S. H. Sahayanesan was appointed Experimental K.P. with effect from 1st August, 1947.

(*g*) *Water Supply to Conductor's Bungalow at Dartonfield.*—As recommended by the Committee, a vote of Rs. 420/- was passed to cover the cost of providing a pipe-borne water supply to the Conductor's bungalow at Dartonfield.

The minutes were adopted.

5. **Reports and Accounts.—**

(*a*) *Director's Report for the 1st Quarter*, 1947—was approved.

(*b*) *Estate Accounts, January to April*, 1947—were tabled.

(*c*) *Finance.*—The sale of Rs. 30,000/- stock of 3% National Loan, 1953 to provide liquid cash to meet anticipated commitments was approved.

(*d*) *Rent Allowance.*—It was agreed that a minimum rent allowance of Rs. 5/- per month should be paid to married officers, as provided in correction slip No. 273 to Financial Regulation 976.

Mr. J. D. Farquharson came into the meeting.

6. **Re-organisation of Botanical-Mycological Department.**—In view of the difficulty of recruiting suitable research officers from abroad at the present time the Director and the Mycologist had submitted proposals for re-organising the Botanical-Mycological Department by appointing a number of junior officers of the Laboratory Assistant type, thus relieving the present senior officers of a good deal of routine recording work. The present senior officers of the Department could then carry out the programme of work laid down by the Board until 1950 when it would be necessary to appoint a Ceylonese graduate of outstanding ability as Assistant Botanist.

The proposals were approved.

7. **Oidium Leaf Disease.**—Col. Young stressed the importance of doing everything possible to eradicate this disease which, he said, appeared to be gaining ground in certain areas. The Director assured the Board that all possible measures were being taken to keep the disease under control; also that investigations were in progress to ascertain the life cycle of the fungus and to find resistant strains of Hevea.

8. **Staff.—**

(*a*) *End of Contract Leave for Botanist and S.H.P.O.*—Noted that the end of contract leave due to these two officers would fall due towards the end of the year. Agreed that the Botanist should have a further month's leave and that his leave should commence in September.

(*b*) *Junior Staff.*—Agreed that the junior staff be paid a special allowance of 10% of salary in addition to the present dearness allowance.

9. **Publication.**—Advisory Circular No. 17 was tabled.

The meeting then terminated.

C. D. DE FONSEKA,
Secretary-Accountant.

RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the 85th Meeting of the Rubber Research Board held at the Secretariat, Colombo, at 2-30 p.m., on Monday, 3rd November, 1947.

Present.—Mr. D. Rhind (in the chair), Mr. T. D. Perera, C.C.S. (Deputy Secretary to the Treasury), Mr. Simon Abeywickreme, M.P., Mr. T. Amarasuriya, Mr. W. H. Attfield, Mr. W. Neal de Alwis, J.P., Mr. W. P. H. Dias, J.P., Mr. A. M. Clement Dias, Mr. Noel de Silva, The Hon'ble Mr. G. E. de Silva, M.P., Mr. T. C. A. de Soysa, Mr. F. H. Griffith, M.P., Mr. R. J. Hartley, Mr. A. D. Layton, Mr. R. C. L. Notley, Mr. F. A. Obeyesekere and Col. J. T. Young.

Dr. E. Rhodes, Director, was present by invitation.

Before commencing the business of the meeting the Chairman announced that as Director of Agriculture he had assumed duties as Chairman of the Board on 20th October, 1947.

1. **Minutes.**—Draft minutes of the meeting held on 28th July, 1947, which had been circulated to members, were signed by the Chairman on signification of members' assent that they were in order.

2. **Draft Estimates for 1948.**—Draft estimates providing for income and expenditure as follows were approved :

Income			Rs. 441,412
Expenditure :			
Revenue	Rs. 478,628	...	
Capital	,, 52,495	...	,, 531,123
Excess of Expenditure over Income ...		...	Rs. 89,711

It was noted that the Scheme's reserves would be extinguished in 1948 and a Sub-Committee consisting of the Chairman, the Director and the Treasury representative was appointed to consider the Scheme's finances and place before the Board proposals for continuing the work of the Scheme stating the minimum staff and funds required.

3. **Decisions by Circulation of Papers.**—Reported that the Chairman's proposals regarding resolutions passed at meetings had been approved.

4. **Confirmation of Decisions at Last Meeting.**—Decisions at the last meeting in respect of items which had not been on the agenda were confirmed and it was also agreed that an annual questionnaire be issued to estates with the object of acquiring information regarding the incidence and effects of Oidium in the various districts.

5. **Board.**—The following changes in membership were reported :—

(*a*) Mr. F. H. Griffith, M.P., had resumed membership with effect from 22nd August, 1947, relieving Mr. J. D. Farquharson who had been acting for him.

(*b*) Mr. T. D. Perera, C.C.S., Deputy Secretary to the Treasury, had been nominated to represent the Minister of Finance with effect from 23rd October, 1947 in place of Mr. H. E. Peries, C.C.S.

Messrs. Griffith and Perera were welcomed to the Board and Messrs. Farquharson and Peries thanked for their services.

6. **Experimental Committee.**—Recommendations made at meeting held on 2nd October, 1947 :—

(*a*) *Visiting Agent.*—The recommendation that the post of Visiting Agent be offered to Mr. W. A. Paterson at an increased fee was approved.

(*b*) *Staff.*—The resignations of the Estate Superintendent, Conductor, and Head Estate Clerk were accepted and the Director's proposals for the future working of the estates were approved.

Mr. Amarasuriya left the meeting.

(*c*) *Extension of Hedigalla Cart Road.*—Agreed that the work be done on estate account after approval by the Experimental Committee.

Messrs. Abeywickrema and Hartley left the meeting.

(*d*) *Construction of Two Junior Staff Bungalows at Hedigalla.*—Agreed that W. J. de Silva's tender be accepted and a contract awarded to him for the construction of two junior staff bungalows at Hedigalla.

The minutes were adopted.

7. **Reports and Accounts.**—

(*a*) *Director's Report for the 2nd Quarter*, 1947—was approved.

(*b*) *Estate Accounts for May and June*, 1947—were tabled.

(*c*) *Balance Sheet and Auditor's Report for* 1946—were adopted.

(*d*) *Research Programmes for* 1948—were approved.

8. **Staff.**—

(*a*) *Mycologist.*—A letter from Mr. C. G. Hansford giving notice of resignation was read and its contents noted with regret.

(*b*) *Chemist.*—It was noted with regret that Mr. M. W. Philpott's service agreement which was due to terminate in June, 1948, might not be renewed as he had received an offer of employment on better terms elsewhere.

(*c*) *Junior Staff.*—Changes in staff were reported.

9. **London Advisory Committee.**—

Minutes of Meetings of the Committee and the Technical Sub-Committee held on 27th June, 1947—were tabled.

10. **Correspondence with the Director of Commerce and Industries.**—A request from the Director of Commerce and Industries for temporary laboratory facilities at Dartonfield for two Laboratory Assistants of the Rubber Technologist's Department was considered and approved.

11. **Publications.**—The following publications were tabled :—

Advisory Circular No. 26.
Combined 1st and 2nd Quarterly Circular for 1947.

The meeting terminated with a vote of thanks to the Chair.

C. D. DE FONSEKA,
Secretary-Accountant.

London Advisory Committee for Rubber Research (Ceylon and Malaya)

Member nominated by the Colonial Advisory Council of Agriculture and Animal Health:

Dr. H. H. Storey, F.R.S.

Member nominated by the Government of Ceylon:

Mr. L. Lord

Member nominated by the Governments in British Malaya:

Mr. J. Lornie, C.M.G.

Members representing Malayan Planting Interests—nominated by the Rubber Growers' Association:

Mr. P. J. Burgess (*Chairman*)
Mr. J. W. M. Kennedy
Sir Eric Macfadyen

Members representing Ceylon Planting Interests—nominated by the Rubber Growers' Association:

Mr. G. H. Masefield
Mr. E. W. Whitelaw
Mr. H. W. Horner

Member representing Manufacturing Interests:

Lieutenant-Colonel J. Sealy-Clarke

Ex-Officio Members:

Sir H. A. F. Lindsay, K.C.I.E., C.B.E., Director of the Imperial Institute
Professor V. H. Blackman, Director of the Botanical Laboratories, Imperial College of Science and Technology
Dr. S. P. Wiltshire, Director of the Imperial Mycological Institute
Dr. W. G. Ogg, Director of the Rothamsted Experimental Station

Secretary:

Mr. J. A. Nelson, B.Sc.

The Technical Sub-Committee consists of Members of the Advisory Committee with the following co-opted Members:

Mr. G. Martin (Superintendent of Rubber Investigations)
Mr. G. E. Coombs
Mr. L. J. Bennett
Dr. Samuel Pickles
Dr. J. R. Scott
Dr. W. C. Davey
Sir Harold Tempany, C.B.E.

STAFF

Mr. G. Martin, B.Sc., A.R.I.C., F.I.R.I.
Mr. H. C. Baker, M.Sc., A.R.I.C., A.I.R.I.
Mr. W. G. Wren, B.Sc., A.R.C.S.

RUBBER RESEARCH SCHEME (CEYLON)

LIST OF PUBLICATIONS FOR SALE

Bulletins No. 1-20. Bound volume **Rs. 5·00. Later Bulletins Re. 1·00** per copy

No. 1. The Effect of Tapping on the Movements of Plant Food in *Hevea Braziliensis.*
No. 2. The Effect of Tapping on the Movements of Plant Food in *Hevea Braziliensis.*
No. 3. Seasonal Variations in the Movements of Plant Food in *Hevea Braziliensis,* Part I.
No. 4. The Physiological Effects of Various Tapping Systems, Part I.
No. 5. Progress Report on Vulcanization Tests.
No. 6. The Physiological Effects of Various Tapping Systems, Part II.
No. 7. The Physiological Effects of Various Tapping Systems, Part III.
No. 8. Seasonal Variations in the Movements of Plant Food in *Hevea Braziliensis,* Part II.
No. 9. Vulcanization Tests.
No. 10. Vulcanization Tests.
No. 11. Variability in Rubber Manufacture.
No. 12. Progress Report of the Rubber Research Chemist.
No. 13. Vulcanization Tests.
No. 14. On the Variation in the Number of Latex Vessels present in *Hevea Braziliensis.*
No. 15. Vulcanization Tests.
No. 16. On the Natural Clotting of Rubber Latex.
No. 17. Vulcanization Tests.
No. 18. Measurements of "Bark Renewal."
No. 19. Vulcanization Tests.
No. 20. Vulcanization Tests.
No. 21. Vulcanization Tests 1919
No. 22. Vulcanization Tests 1919
No. 23. Vulcanization Tests 1920
No. 24. Vulcanization Tests 1920
No. 25. Investigations on Samples of Plantation Para Rubber from Ceylon 1921
No. 26. Result of Trials of Ceylon Plantation Rubber for the Manufacture of Ebonite 1921
No. 27. Investigations on Samples of Plantation Para Rubber from Ceylon (Out of Print) 1921
No. 28. Investigations on Samples of Plantation Para Rubber from Ceylon 1922
No. 29. Summary of the Principal Results obtained from Investigations into the Properties of Ceylon Plantation Rubber in Relation to its Method of Preparation 1922
No. 30. The Penetration of Disinfectant on the Tapping Out of *Hevea Braziliensis.* (Out of Print) 1922
No. 31. On the Occurrence "of Rust" on Sheet Rubber 1923
No. 32. On the Preservation of Latex 1924
No. 33. Investigations on Samples of Plantation Para Rubber from Ceylon 1924
No. 34. Investigations on Samples of Plantation Para Rubber from Ceylon 1924
No. 35. Investigations on Samples of Plantation Para Rubber from Ceylon 1924
No. 36. Investigations on Samples of Plantation Para Rubber from Ceylon 1924
No. 37. Investigations on Samples of Plantation Para Rubber from Ceylon 1924
No. 38. Investigations on Samples of Plantation Para Rubber from Ceylon 1925
No. 39. Investigations on (Final Report Series I) 1925
No. 40. Investigations on Series II 1926
No. 41. Investigations on First Interim Report on Artificial Ageing Tests 1926
No. 42. On the Smoking of Sheet Rubber in Relation to Mould Prevention 1926
No. 43. The Inter-Relationship of Yield and the Various Vegetative Characters in *Hevea Braziliensis.* (Out of Print) 1926
No. 44. The Construction of Smokehouses for Small Rubber Estates (Out of Date) 1926
No. 45. The Efficiency of Disinfectants and Fungicides 1927
No. 46. The Control of Bark Rot by Disinfectants 1927
No. 47. Report on Variability of Ceylon Estate Grades 1927
No. 48. Brown Bast and its Treatment. (Out of Print) 1928
No. 49. Report on Causes of Variation in Plasticity 1928
No. 50. Crepe Rolling 1929
No. 51. The Curing of Sheet Rubber 1930
No. 52. The Preparation of Uniform Rubber 1932
No. 53. Oidium Leaf Disease 1936
No. 54. Report on a Visit to Malaya, Java and Sumatra 1937

Handbooks at Rs. 2·50 per copy.

The Preparation of Plantation Rubber.
Diseases of Rubber in Ceylon, by R. K. S. Murray, A.R.C.Sc., Mycologist.
The Budding of Rubber, by R.A. Taylor, B.Sc., Physiological Botanist (Out of Date).